

Risks and complications in surgically assisted rapid maxillary expansion

Riscos e intercorrências na expansão rápida de maxila cirurgicamente assistida

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ABSTRACT

Rapid maxillary expansion is generally contra-indicated in patients with incomplete bone formation, and is only used as an alternative in those with advanced skeletal age. In young patients, Haas and Hyrax expanders are indicated and are chosen according to requirements. In adults, an application of orthodontic-surgical techniques allows correction of transversal and other deformities, offering very acceptable and predictable results while increasing the maxillary arch perimeter to correct the posterior crossbite. However, there have been reports of related complications, such as significant hemorrhage, gingival recession, root resorption, devitalization of teeth, sinus infection, oculomotor nerve paralysis, and orbital compartment syndrome. Maxillofacial surgeons should be aware of such possible complications and that patients are fully informed. This study reviews available literature and presents a case of surgical treatment, with the aim of reviewing complications occurring during the orthognathic surgery for opening the midpalatal suture.

Indexing terms: Complications. Orthognathic surgery. Palatal expansion technique.

RESUMO

A expansão rápida da maxila cirurgicamente assistida é contra-indicada, na maioria dos casos, em pacientes com maturidade óssea incompleta, sendo indicada apenas àqueles pacientes com idade óssea avançada. A cirurgia aumenta o perímetro do arco maxilar, corrigindo as mordidas cruzadas. Nos pacientes jovens, são usados aparelhos expansores do tipo Haas e Hyrax, escolhidos de acordo com as necessidades de cada paciente. Nos adultos, as aplicações das técnicas ortodôntico-cirúrgicas, possibilitam a correção de deformidades transversais, com uma previsibilidade bastante aceitável e, com poucos relatos de complicações. Complicações como hemorragia significativa, recessão gengival, reabsorção radicular, desvitalização de dentes, sinusite, paralisia do nervo oculomotor, e síndrome do compartimento orbital foram descritas. Cirurgiões maxilofaciais devem estar cientes de tais complicações e que os pacientes devem estar plenamente informados. Este estudo, revisa a literatura disponível e apresenta um caso de tratamento cirúrgico, com a finalidade de, expor as possíveis complicações da cirurgia ortognática.

Termos de indexação: Complicações. Cirurgia ortognática. Técnica de expansão palatina.

INTRODUCTION

Rapid maxillary expansion (RME) is often used to improve orthodontic results by increasing the maxillary transverse dimension in young patients¹⁻⁶. The force exerted by expanders (Haas-type and Hyrax) opens the midpalatal suture⁵⁻⁶. Such appliances are most commonly used in children, but fail in teenagers and adults, thus RME is less effective in those ages^{2,4,6}.

Some studies have reported the risks and effects of RME in periodontal, skeletal, dental, ducts, orbital and nasal changes in patients after this orthognathic surgery^{1-2,4-8}.

Surgically assisted rapid palatal expansion is an alternative to achieve effective maxillary expansion in skeletally mature patients^{1,3-4}. However, some authors have reported that this technique has low morbidity^{1,3}.

Surgical or orthodontic techniques increase maxillary arch perimeter to correct posterior crossbite to prove space for a crowded maxillary and others purposes^{1,4-5,7-8}.

Pre-operative planning includes soft tissue evaluation, and the type of presenting maxillary transverse deficiency and buccal lingual inclination of the posterior teeth⁸. The patient's age is considered as the fundamental

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basis for distinguishing either the use of rapid maxillary expansion or surgically assisted rapid palatal expansion^{4,8}.

This study aims to review available literature, and to present a case of rapid maxillary expansion (RME).

CASE REPORT

The patient is a 38-year-old female with midfacial retrusion and significant transverse deficiency (Figure 2). Lateral cephalometric analysis showed abnormal values. An orthodontic treatment regime was initiated for posterior surgery treatment (Figure 1). The patient was taken to the Hospital ater to undergo surgically assisted rapid palatal expansion under general anesthesia using naso-tracheal intubation. A saw was used in the initial procedure to make horizontal bone cuts in both sides through the lateral walls of the maxilla, from the maxillary tuberosity to the piriform fossa region. The medial wall of the maxillary sinus was not included in the cut, and a pterygomaxillary separation was not performed. A diamond disc was used to make a cut through the labial cortex directly between the roots of the maxillary central incisors. A fine osteotome was then used to section between the roots of the central incisors and this was continued along the midpalatal suture to the posterior end of the hard palate without perforating the palatal mucosa (Figure 5). An analysis of the orthodontic expansion required between the central incisors was made before and after the procedure. At this point the expander was activated by turning the expansion screw 10 one-quarter turns (2.5 mm). In this present case, bleeding occurred in the tuber of the maxilla, (due to the proximity of the pterygoid venous plexus), and the nasal cavity, controlled respectively by the use of a fibrin sponge and nasal packing. The surgically assisted rapid palatal expansion procedure continued without further complications (Figure 4). Homeostasis was ensured and sutures put in place.

This work was analyzed and approved by the Ethic Committee of Federal University of Juiz de Fora (protocol number 369/2008).

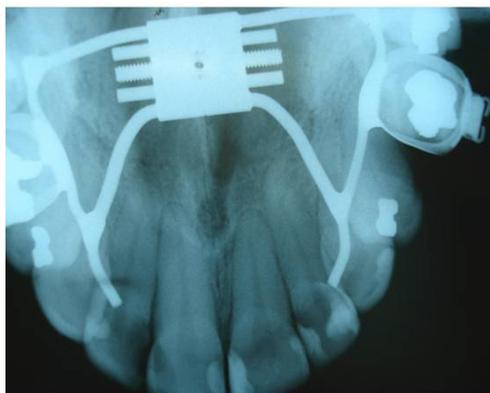


Figure 1. Orthodontic treatment regime was initiated for posterior surgery treatment.



Figure 2. Patient midfacial retrusion and significant transverse deficiency.

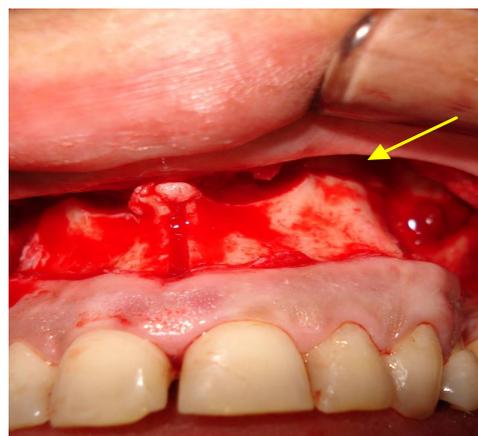


Figure 3. Bilateral horizontal bone cuts through the lateral walls of the maxilla extending from the maxillary tuberosity to the piriform fossa region.



Figure 4. Surgically assisted rapid palatal expansion procedure completed without further complications.

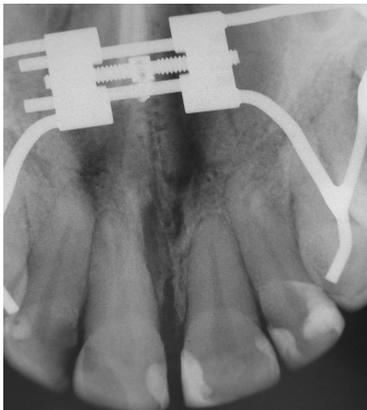


Figure 5. Radiography showing osteotomy used to section between roots of the central incisors and subsequent separation along the midpalatal.



Figure 6. Schematic illustration: red line represents an incorrect disjunction; black line represents a correct disjunction.

DISCUSSION

The objective of this study was to conduct a review of a surgically assisted RME, describe a clinical case including the closure of sutures, and discuss complications associated with this technique.

The choice of using either RME or surgically-assisted RME is directly related to the closure of sutures and the age of the patient. Surgically-assisted rapid palatal expansion (RPE) is indicated in patients over 16 years old^{1,2,9} with an upper age limit of 25 years^{1-2,9-10}. Some studies have specified the appropriate upper age limit to be 25 years in men, and 20 years for women^{1-2,11}. This surgery is recommended after the second decade of life^{1-2,12}. Research also suggests that orthognathic maxillary expansion is successful in patients younger than 12, and that corticotomies are essential in patients over 14 years^{1-2,13}.

Many studies have reported the connection between the closure of sutures and the patient's age, and type of expansion¹⁴⁻¹⁷. For example, Latham & Burston¹⁴ state that, in general, after about 2 or 3 years of age the skull sutures function primarily as sites of bone union, although localized remodeling seems to be a continuing process. In agreement with this assumption, Sicher¹⁵ declares that the closure of sutures usually starts in the mid-30s at the posterior part of the median palatine suture. Person¹⁶ added that there is evidence of bony ossification at 17 years old. However, Latham & Burston⁹ report that there is no evidence of synostosis in the same suture by the age of 18 years, Baurind & Korn¹⁷ reported that the maxillary sutures close at approximately 14-15 years of age in females and at approximately 15-16 years of age in males. These outcomes suggest that, in spite of the majority of facial sutures appearing to be open on the surface of old skulls, some degree of union may be present in the substance of the suture¹⁸.

Although surgically assisted rapid palatal expansion procedures have been reported to have low morbidity, some complications have been described¹⁻². Several articles have described complications associated with maxillary expansion; for example, significant hemorrhaging and subsequent gingival recession^{1-2,19}. Root resorption has also been reported^{1-2,13,20}. Injuries to the branches of the maxillary nerve, infection, pain, devitalization of the teeth, and altered pulpal blood flow have also been reported^{1-2,13,20}. However, if performed under the correct protocol pulpal blood flow is not affected²⁰. Other complications such as periodontal breakdown^{1,6,21}, sinus infection^{1,22}, alar base flaring^{1,9,22}, relapse, and unilateral expansion^{1,22} have also been reported. In the case of unilateral expansion it is necessary to wait for consolidation to re-evaluate any esthetic defect and evaluate the possibility of further surgical intervention (Figure 6).

Breakage, stripping, or locking of the appliance screw^{1,22}, and its loosening and impingement on top alatal soft tissue^{1,6,23} have also been related as possible complications. The incidence of frank aseptic tissue is about 1.8%, and at least 5% of the patients suffer some type of palatal ulceration^{6,24}. Hemorrhage can also be life-threatening^{1-2,22} requiring blood transfusions and additional hospital stay^{1,11}, or present as a minor posterior epistaxis^{1-2,7,22}. Life threatening epistaxis caused by cerebrovascular accident, skull base fracture with reversible oculomotor nerve paralysis, and orbital compartment syndrome have been described previously^{6,25}, and the latter has been described as a possible cause of permanent blindness⁴. Undesirable fractures of the maxillary articulation, and asymmetric fractures of the interdental bone between the central incisors, are commonly seen^{1-2,21-22}. Glassman et al.^{1-2,26} have also described extrusion of the teeth attached to the gadget. In the particular technique described by Glassman, and in other conservative techniques, the fracture of the alveolar process is recommended²⁶.

It is possible to observe an increase in stress on the skull base, particularly on the optic foramen, if the procedure is performed without separation^{1,22,27}. Other complications include bilateral lingual anesthesia^{1-2,22,28}, nasopalatine canal cysts^{1,22,29}, increased nasal volume and decreased nasal resistance²⁹, a decreased craniocervical angle and increased cervical lordosis angle^{5,7}, and a positive effect on the hearing levels in persons with conductive hearing loss^{5,7}.

Some effects noted on the skull include a maxillary slight, an increase of anterior facial height³⁰ and maxillary and nasal width^{1-2,5-6}, buccal bone plate thickness reduction, increased lingual bone plate thickness (mostly in the posterior teeth)⁷, and a reduction as a whole of both

buccal bone thickness and buccal marginal bone levels of the posterior teeth^{7-8,30}. No significant effects have been seen in pharyngeal airway dimensions or the hyoid position in adults^{8,28-29}.

CONCLUSION

Surgically assisted rapid palatal expansion is a widely used procedure for the correction of transverse maxillary deficiency in skeletally mature patients. However, no definitive way exists that combines successful outcomes from various surgical procedures, and that ensures adequate mobilization in combination with the most conservative procedure. Therefore, it is considered necessary that surgeons are fully informed of all possible complications, and that such information is transmitted to prospective patients.

Collaborators

ES URBANO, was responsible for the surgical procedure described in the item case report, as well as supervision and collection of references and writing up the paper. KA MELO was responsible for the of the monitoring of the case, collection of bibliographic references and also has participated in the preparation of the scientific article. ST Costa, was responsible for monitoring the case, collection of bibliographic references, and also has participated in the preparation of the scientific article. RSS STEHLING, responsible for the surgical procedure described in the item case report, as well as supervision and collection of references and writing up the paper.

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